FAA and Industry Guide to

REUSABLE LAUNCH VEHICLE

Operations Safety Approval

Version 1.0

Office of the Associate Administrator for Commercial Space Transportation
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FAA AND INDUSTRY GUIDE TO REUSABLE LAUNCH VEHICLE OPERATIONS SAFETY APPROVALS

VERSION 1.0

Office of the Associate Administrator for
Commercial Space Transportation

Federal Aviation Administration

Associate Administrator for Commercial Space Transportation
Attention: Licensing and Safety Division (AST-200)
800 Independence Avenue, Room 331
Washington, DC 20591

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1.0 INTRODUCTION

1.1 BACKGROUND

The Associate Administrator for Commercial Space Transportation (AST) held pre-application consultations with several prospective reusable launch vehicle (RLV) developers and operators who have exhibited a wide range of design concepts and proposals. In addition, inquiries and applications for safety approval at various Federal Aviation Administration (FAA) field offices were analyzed. As a result, the FAA determined that expertise in such technical areas as aerospace safety engineering, propulsion systems, aerodynamic structures, and software is required to conduct safety evaluations of RLVs. The focus of such evaluations includes, but is not limited to, aircraft system and subsystem design, aircraft certification, operations and maintenance, medical certification, crew systems, and system safety. The technical expertise may be obtained from sources distributed throughout the FAA various lines of business (LOBs) or external to the agency.

To provide a corporate framework for addressing the needs of the FAA and the RLV industry, the Commercial Space Transportation Integrated Product Team (CSTIPT) was established in August 1998. Developing a corporate policy governing the RLV safety review process is primarily the responsibility of AST and the Associate Administrator for Regulation and Certification (AVR) who make up the Commercial Space Transportation Executive Steering Group. Other members of the CSTIPT include the FAA Office of System Safety (ASY), Office of the Chief Counsel (AGC), Office of Air Traffic Services (ATS), Office of Airports (ARP), Office of Research and Acquisitions (ARA), and Office of Policy, Planning & International Aviation (API).

1.2 PURPOSE

This guide describes the RLV Operations Safety Approval Process used by the FAA in partnership with industry to assess the safety of proposed commercial RLV concepts. Tasks that need to be performed by the Applicant and the FAA to issue these approvals, certificates, and licenses are discussed. The guide provides an overview of how to plan, manage, and control an effective and efficient safety approval process for RLVs and details the working relationship between the FAA and the Applicant. Although this guide focuses on large, complex programs, the principles of up-front planning, project management, and thorough documentation discussed here apply to all RLV applications. It must be noted that this safety approval process leads to the licensing of space launches. Following the safety approvals, the FAA makes a determination on the issuance of a license.

The FAA and RLV industry are committed to ensuring safe launch, reentry, and operation of RLVs by establishing up-front a clear understanding of the needs and expectations of both parties in the application, certification, and licensing processes. Reducing the cycle time required to approve launches, while simultaneously ensuring regulatory compliance, requires mutual early coordination and involvement in project planning, open and constructive communication, and safety-focused project management. Early involvement helps identify and resolve areas of mutual concern, means of compliance, and special conditions.

1.3 SUCCESS FACTORS

Figure 1-1 shows factors that will have to be embedded in the cultures of both the FAA and the Applicant to ensure a successful safety approval process: teamwork, communication, quality products and services, accountability at all levels, and planning for success.

Figure 1-1. *Criteria for a Successful Safety Approval Process*

These success factors can be engrained in the process if all key stakeholders use them as fundamental norms for all FAA and Applicant interactions and apply them throughout all phases of this iterative process. Appendix 1 lists key stakeholder roles and responsibilities of the FAA and the Applicant. A glossary of FAA organizational codes, acronyms, and terms used in this guide is provided in Appendix 2.

1.3.1 TEAMWORK

- Establishing and maintaining mutual trust and confidentiality.
- Meeting commitments.

1.3.2 COMMUNICATIONS

- Maintaining open and timely communication.
- Conducting early familiarization meetings.
- Conducting meetings using structured agendas.
- Ensuring that key stakeholders attend the appropriate meetings.
- Documenting agreements, issues, and actions.

1.3.3 ACCOUNTABILITY

- Emphasizing empowerment.
- Agreeing to clear timeframes, expectations, and action plans.

1.3.4 QUALITY PRODUCTS AND SERVICES

- Producing timely, high quality documentation of decisions, agreements, schedules, milestones, action item assignments, compliance submittals, and approvals.

1.3.5 PLANNING FOR SUCCESS

- Providing proper levels of technical, project, and management leadership.
- Conducting frequent reviews to ensure all parties are aware of the status of the project, significant issues, and commitments.

2.0 RLV OPERATIONS SAFETY APPROVAL PROCESS

2.0.1 OVERVIEW

The RLV Operations Safety Approval Process informally begins at the first contact between the Applicant and FAA. The first contact can occur in many ways, but it usually happens when an Applicant approaches either AST, a Flight Standard District Office, or an Aircraft Certification Office to inquire about the certification and licensing process needed for their vehicle. Applicants should contact the FAA Commercial Space Transportation Systems Development Division (AST-100) to begin the process. AST serves as the lead in reviewing potential applicants to determine if a Safety Approval Project is warranted.

Following initial contact between the FAA and Applicant, the RLV Safety Approval Process formally begins. Figure 2-1 shows the RLV Operations Safety Approval Process used to grant the necessary safety approvals[1] needed by an Applicant who is planning to develop an RLV system. Note that phases 1, 2, 3, and 4 address efforts that occur during the pre-application consultation and coordination stage of licensing. Significant sections of the complete launch license application that an Applicant submits to the FAA are derived from deliverables developed, approved, or both, during these pre-application consultation and coordination efforts. Activities that occur when the applicant submits the complete launch license application and FAA issues a launch or reentry license are beyond the scope of this guide. FAA Advisory Circular 413-1, *License Application Procedures*, provides detailed information regarding the application process.

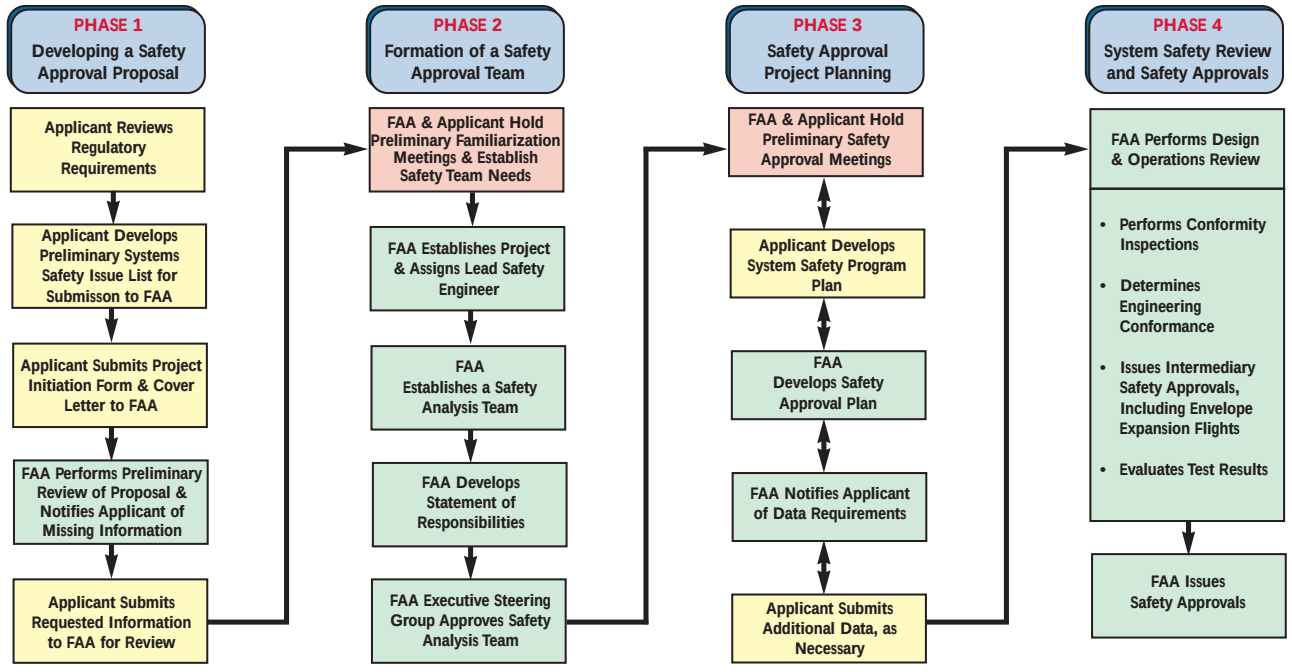


Figure 2-1. *Reusable Launch Vehicle Operations Safety Approval Process*

1 *A currently licensed example of multiple safety approvals is Orbital's Pegasus launch vehicle. The Pegasus/L-1011 launch vehicle operates under a launch license and a restricted category certificate for the L-1011 to carry the Pegasus. In addition, Pegasus ferry flights from California to the East Coast operate with particular limitations regarding overflight of populated areas.*

Deliverables are prerequisites for subsequent phases and must be completed before entering the next phase, unless otherwise mutually agreed by the FAA and the Applicant. Prospective Applicants are advised to consult with the FAA to discuss the application process and potential issues relevant to the FAA's safety approval decisions and processes. Early and frequent pre-application consultation and coordination between FAA and the Applicant are critical requirements during this iterative process.

The FAA uses the safety approval process to grant the necessary safety approvals to Applicants planning to develop an RLV system. The early process is focused on the development of a Safety Approval Plan (SAP) by the FAA's multidisciplinary Safety Approval Team (SAT). Although it is a "living" document subject to change, this SAP is then followed for the remainder of the process. Such plans may include various interim safety approvals, such as experimental certificates and test flights. The SAT uses the applicable statutory authority and safety criteria associated with the operation being performed for each safety approval granted or denied.

To a large extent, the length of each phase depends on the development life cycle of the system. The FAA intends to work with Applicants in a manner that represents an integrated corporate process and results in safe RLV operations. The nature of the specific proposed concept and operation determine the makeup of the SAT and the content of the SAP. Although no two safety approval applications are the same, the approach outlined here helps to achieve an effective partnership between the FAA and the Applicant and applies to any RLV proposal.

2.0.2 KEY PROCESSES AND DOCUMENTS

Figure 2-2 highlights the four processes and resulting documents that serve as key building blocks to successfully obtaining safety approvals. A brief overview of each is also provided.

- Implementing the Reusable Launch and Reentry Vehicle System Safety Engineering Process
- Developing a System Safety Program Plan
- Documentating Agreements Between the FAA and Applicant in the RLV Operations Safety Approval Plan
- Completing Project Evaluation Reports

Figure 2-2. *Key Building Blocks to Obtaining Safety Approvals*

2.0.2.1 REUSABLE LAUNCH AND REENTRY VEHICLE SYSTEM SAFETY ENGINEERING PROCESS

Applying an organized and logical system safety process methodology for identifying and controlling public safety hazards associated with the operation of reusable launch and reentry vehicle systems is a fundamental responsibility of both the FAA and the Applicant. As a foundation for their safety program, Applicants should implement the reusable launch and reentry vehicle system safety process (also known as the system safety engineering process) described in FAA Advisory Circular 431.35-2, *Reusable Launch and Reentry Vehicle System Safety Process.* This process helps to identify, reduce, and eliminate safety risks. The ability to control risks that cannot be eliminated or further reduced and to keep these risks within acceptable levels throughout the life cycle of a system is also enhanced.

2.0.2.2 SYSTEM SAFETY PROGRAM PLAN

The Applicant develops the System Safety Program Plan (SSPP) by tailoring MIL-STD-882C, *System Safety Program Requirements*, to a commercial RLV program. (See also FAA Advisory Circular 431.35-2.) Applicants should begin developing a preliminary SSPP in coordination with FAA SAT members during phase 1 of the process. This plan should achieve the following objectives:

- Demonstrate a systematic, logical, and disciplined approach for early hazard identification.
- Identify methodologies for addressing risk elimination, reduction, or control during the design, development, and operation of the RLV system.

2.0.2.3 REUSABLE LAUNCH VEHICLE OPERATIONS SAFETY APPROVAL PLAN

This written agreement between the FAA and the Applicant is designed for use as a project management tool, providing milestones, performance measures, and information unique to a safety approval project. Typical content addresses generic processes and procedures, conformity inspections, lines of communication, issue resolution, and metrics for measuring project progress. Uses of this plan include, but are not limited to, the following activities:

- Defining generic procedures for planning the safety approval process.
- Establishing general expectations or operating norms.
- Identifying deliverables.
- Defining the discipline and methodology to be used in planning and administering subsequent specific safety approvals.

2.0.2.4 PROJECT EVALUATION REPORTS

The FAA's Lead Safety Engineer (LSE) and Applicant's Project Manager (PM) jointly prepare the initial, interim, and final project evaluation reports. Both the LSE and PM are encouraged to include the

completion of project evaluation reports as milestones when preparing the SAP schedule. Uses of these reports are as follows:

- Collecting information and providing feedback to the FAA regarding the Applicant's RLV operations safety approval process.
- Identifying areas where corrective action may be required.
- Facilitating continuous improvement.

Corrective actions identified during the reusable launch and reentry vehicle system safety process should be evaluated and implemented by the SAT. Project evaluation reports should be maintained in the permanent records of the project and kept available for future program evaluation.

2.1 PHASE 1: DEVELOPING A SAFETY APPROVAL PROPOSAL

TASKS	
Applicant	**FAA**
▶ Familiarizes themselves with FAA rules and regulations. ▶ Develops a preliminary list of issues that might directly impact public safety. ▶ Completes Project Initiation Form with a cover letter and submits both to the FAA.	▶ Performs preliminary review of Applicant's proposal. ▶ Notifies Applicant of receipt of their Project Initiation Form. ▶ Begins the safety approval process upon receipt of the Project Initiation Form. ▶ Notifies Applicant of missing information.

2.1.1 REVIEWING REGULATORY REQUIREMENTS

This guide supports existing regulatory guidance and provides a well-coordinated corporate framework to assist the FAA and Applicant in identifying the appropriate steps to enable development, testing, and commercial operations of RLVs. The primary reference tools used to prepare and maintain RLV operations license applications and associated records are listed below. In addition to these reference tools, a checklist has been included in Appendix 3 to aid Applicants in understanding their role in the process.

- 14 CFR, parts 400, 401, 404, et. al., Commercial Space Transportation Reusable Launch Vehicle and Reentry Licensing Regulations, Final Rule, September 19, 2000.
- 14 CFR, part 440, Commercial Space Transportation Financial Responsibility Requirements for Licensed Launch Activities, October 26, 1998.

- 14 CFR part 450, Financial Responsibility Requirements for Licensed Reentry Activities, Final Rule, September 19, 2000.
- FAA Advisory Circular 413-1.
- FAA Advisory Circular 431.35-2.
- Military Standard (MIL-STD) 882C.

These Code of Federal Regulations and FAA publications are available at http://ast.faa.gov/lrra/stats_notices.htm. Military Standard 882C is available at http://npoesslib.ipo.noaa.gov/techlib/doc124/doc124.pdf. Change notice 1 for MIL-STD-882C is available on-line at http://www.dsmc.dsm.mil/educdept/mm_dept_resources/guidance/MIL-STD-882C%20%20Ch%20Notice%201.doc.

2.1.2 DEVELOPING A PRELIMINARY LIST OF SYSTEM SAFETY ISSUES AND SYSTEM SAFETY PROGRAM PLAN

A preliminary list of system safety issues is essential for identifying potential risks that the Applicant's RLV system could pose to the public. Applicants should review and make a determination regarding any aspect that should be included in this list for FAA evaluation. The list should include, but is not limited to, the following areas of potential risks associated with the proposed vehicle: systems, subsystems, components, and future operations. At this time, the Applicant is also advised to begin developing a preliminary SSPP in consultation with SAT members. The SSPP, which will be submitted to the FAA, requires the inclusion of items identified during development of the preliminary list of system safety issues (see paragraph 2.3.2). This list and SSPP are living documents. Both may be revised significantly and updated frequently as the Applicant moves through the initial phases of the safety approval process.

2.1.3 SUBMITTING A PROJECT INITIATION FORM AND COVER LETTER TO THE FAA

The first form the Applicant submits to the FAA is the Project Initiation Form (see Appendix 4). This form should include the following information regarding the Applicant and the RLV:

- Intentions.
- Three-view conceptual or detailed drawing of the RLV system.
- Public safety issues.
- Development, testing, and operation locations.
- Flight profile.
- Safety approvals the Applicant anticipates requesting from the FAA during development of the RLV system.

Once the Project Initiation Form is completed, the Applicant submits it to the FAA for review with a signed cover letter. The cover letter should contain the name of the primary liaison with the FAA (include all point-of-contact information), a certification of accuracy, and a list of attachments.

The Applicant's Project Initiation Form must be submitted in writing, in English, and delivered to:

FAA, Associate Administrator for Commercial Space Transportation
Attention: Licensing and Safety Division, Application Review (AST-200)
800 Independence Avenue, Room 331
Washington, DC 20591

2.1.4 PERFORMING A PRELIMINARY REVIEW OF THE PROJECT INITIATION FORM

Upon receipt of the Project Initiation Form and cover letter, the FAA screens the form and any attachments. The FAA

- Performs preliminary review of an Applicant's proposal.
- Notifies the Applicant of the receipt of the Project Initiation Form.
- Determines whether the material is sufficiently complete.
- Evaluates the various component submittals for accuracy.
- Notifies the Applicant of missing information.
- Provides Applicant with guidance regarding revisions required to perform the necessary safety assessments and to expedite issuance of the required safety approvals, if necessary.

2.2 PHASE 2: Forming an Integrated Safety Analysis Team

TASKS	
Applicant	**FAA**
▶ Assigns a Program Manager. ▶ Assigns points of contacts for each subsystem area or safety issue area.	▶ Establishes project. ▶ Assigns a Lead Safety Engineer. ▶ Establishes an Integrated Safety Analysis Team (SAT). ▶ SAT develops Statement of Responsibilities for the team. ▶ Provides approval of the SAT via the Executive Steering Group.

2.2.1 CONDUCTING PRELIMINARY FAMILIARIZATION MEETINGS

The FAA and Applicant hold a series of preliminary familiarization meetings. Although no predetermined format exists for these meetings, some take the form of a phased tabletop exercise, involving an exchange of ideas. Applicants begin by:

- Outlining their intentions.
- Describing the design of their RLV system concept.
- Highlighting the various operational phases.
- Addressing issues that might pose a risk to the public.
- Identifying their needs.

FAA begins by

- Describing the various phases of the RLV Operations Safety Approval Process.
- Explaining project requirements and expectations.
- Providing a general overview of the roles and responsibilities of the key stakeholders involved in the safety approval process.

2.2.2 ESTABLISHING A PROJECT AND ASSIGNING A LEAD SAFETY ENGINEER

Once preliminary familiarization meetings have been conducted, the FAA formally establishes a project and assigns a Lead Safety Engineer (LSE) to serve as the primary point of contact with whom the Applicant communicates on all matters. The LSE uses the support of the Applicant and other FAA personnel, such as safety engineers and policy analysts, during this process. Steps AST takes to establish a project include, but are not limited to, the following:

- Reviewing the application and all supporting documentation submitted by the Applicant.
- Determining the expertise needed to establish an integrated SAT.
- Recommending the required team composition to the Executive Steering Group.
- Obtaining approval from the Executive Steering Group to create the SAT.
- Notifying the Applicant of the establishment of the SAT and the name, telephone number, and electronic mail address of the LSE.

2.2.3 ESTABLISHING AN INTEGRATED SAFETY ANALYSIS TEAM

The integrated SAT is responsible for bringing the project to a successful conclusion. The FAA LSE leads the integrated SAT, and initial efforts typically focus on the composition of the SAT and development of the SAP. The SAT uses a fully integrated corporate process to ensure that activities conducted under statutory authorities other than 49 USC, Subtitle IX, Chapter 701 (the Commercial Space Act), are appropriately reviewed and approved by cognizant SAT members, so the FAA can adequately make a determination regarding the safety of the requested launch and re-entry operations.

2.2.3.1 DETERMINING SAFETY ANALYSIS TEAM COMPOSITION

This multidisciplinary team is typically comprised of members with expertise in such areas as safety engineering, operations, and environmental impacts. However, the exact composition varies depending on the specific RLV concepts the Applicant proposes to develop. Members are drawn from the following sources:

- FAA Commercial Space Transportation, Licensing and Safety Division.
- FAA Commercial Space Transportation, Systems Engineering and Training Divisions.
- Other FAA lines of business (see Appendixes 1 and 2).
- Other governmental agencies.

Government contractors who independently assess system concepts, designs, safety analyses, ground tests, and flight tests may also augment the team. Other external efforts may include analysis of hazards, risks, failures, flight dynamics, and systems.

2.2.3.2 DEVELOPING THE STATEMENT OF RESPONSIBILITIES

The SAT and CSTIPT develop the "Statement of Responsibilities," which describes expectations from each stakeholder involved in the project. For example, some concepts might involve the review and approval of modifications to an existing aircraft or rocket system. These reviews and approvals require resources from the AST and AVR. Such requirements are listed in the "Statement of Responsibilities."

2.2.4 APPROVING THE SAFETY ANALYSIS TEAM

Once AST establishes the SAT, the Executive Steering Group approves the composition and structure of the team. Following this approval, the LSE notifies the Applicant of the establishment of the SAT. Applicants are also given a copy of the "Statement of Responsibilities."

2.2.5 BEGINNING THE PROJECT EVALUATION REPORTS

At the end of phase 2, the FAA LSE and the Applicant's PM should jointly create a format for the project evaluation reports that is specific to the needs of the RLV application. Often similar in form to a progress or status report, these reports should be filled out by both parties throughout the remainder of the safety approval process. All thoughts and ideas should be captured. The FAA uses them to collect feedback from the Applicant and identify corrective actions for this safety approval process. The SAT will evaluate the project evaluation reports throughout the process and implement necessary changes to the safety approval process.

2.3 PHASE 3: SAFETY APPROVAL PROJECT PLANNING

TASKS	
Applicant	**FAA**
▶ Supplies the FAA with the detailed concept description, schedules, milestones, and other information required to expedite the development of the project plan. ▶ Works with the FAA in developing the Safety Approval Plan. ▶ Develops and maintains a "living" Action Item List, identifying additional information needed by the FAA in support of the safety approval process. ▶ Provides a detailed System Safety Program Plan which: – Describes the manner in which the Applicant intends to satisfy FAA rules and regulations. – Outlines the proposed risk analysis, mitigation, and reduction strategies.	▶ Plans the evaluation of the results of the Applicant's safety analyses and tests. ▶ Determines whether the public safety requirements and operational safety standards are adequately addressed and subsequently met. ▶ Ensures the Applicant maintains a "living" Action Item List. ▶ Informs the applicant of data requirements.

2.3.1 HOLDING SAFETY PLANNING MEETINGS

This phase is characterized by frequent routine interchanges between the FAA and the Applicant team members. The Applicant and the FAA conduct safety planning meetings to review the proposed concept, obtain clarification, and exchange technical ideas. These meetings:

- Continue as long as is necessary.
- Are conducted in phase with the Applicant's analyses, design, manufacturing, and testing of the system and the vehicle in order to ensure a clear understanding of all aspects of the overall proposed RLV system.
- Are held at the Applicant's site or the FAA's site, depending on the issues to be discussed and the resources needed to support these discussions.

2.3.2 DEVELOPING THE SYSTEM SAFETY PROGRAM PLAN

Once the FAA and Applicant have a good understanding of each other's safety requirements, the Applicant develops a detailed SSPP by tailoring MIL-STD-882C, *System Safety Program Requirements*, to meet the needs of its commercial RLV program (see also FAA Advisory Circular 431.35-2). For the SSPP to qualify as acceptable, the system safety engineering process used shall be comparable to that reflected in the following publications:

- Military Standard (MIL-STD) 882C.
- *System Safety Analysis Handbook (A System Safety Society Standard).*
- FAA Advisory Circular 25.1309, System Design and Analysis.

The Applicant should consider implementing the Reusable Launch and Reentry Vehicle System Safety Engineering Process as a foundation for their safety program when developing the SSPP (see FAA Advisory Circular 431.35-2). The intent of this process is to identify and eliminate, reduce, or control risks to the public to acceptable levels throughout the life cycle of a system.

2.3.3 DEVELOPING THE PRELIMINARY SAFETY APPROVAL PLAN

The SAT leads to development of the SAP. This plan is the principle project coordination tool and is based on the Applicant's activities as outlined in the SSPP. The LSE is responsible for updating the SAP. The preliminary SAP:

- Defines a working relationship between the FAA and the Applicant.
- Provides the foundation from which to build mutual trust, leadership, teamwork, and efficient business practices.
- Enables team members to expedite approval projects by focusing on safety significant issues.
- States how the FAA will conduct its safety approval process.

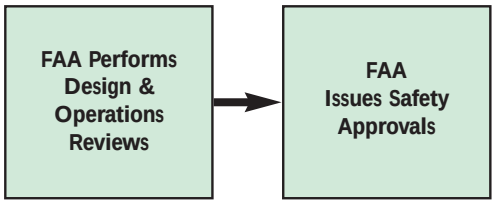
2.3.4 NOTIFYING APPLICANTS OF DATA REQUIREMENTS

Requests for missing data may occur throughout the development of the SAP. However, by this stage, the Applicant should have an enhanced understanding of the steps necessary to make an adequate demonstration based on the concept and strategy proposed. The FAA will:

- Require the Applicant to submit any missing information in order to complete the process.
- Provide the Applicant with a reasonable amount of time to submit the information after receiving a request for information.
- Base the amount of time Applicants have for submitting missing information on the schedule established by the FAA and Applicant in the SAP.

The FAA anticipates that independent safety analyses on some portions of the Applicant's RLV launch and reentry systems, safety critical elements, and operations may be required. Such analyses may be performed by contractors and should be considered during the planning process.

2.4 PHASE 4: System Safety Review and Safety Approval



TASKS	
Applicant	**FAA**
▶ Provides information regarding subsystem performance and reliability. ▶ Provides any data that is used to validate vehicle system reliability, performance, and ability to meet the FAA safety requirements. ▶ Conducts a structured system safety process. ▶ Adheres to operational requirements and limitations. ▶ Supports any independent safety analyses that the FAA may deem appropriate in assessing information and data provided by the Applicant.	▶ Evaluates the results of the Applicant's safety analyses. ▶ Determines whether the public safety requirements and operational safety standards are adequately addressed and subsequently met. ▶ Determines whether independent safety analyses on some portions of the Applicant's RLV launch and reentry systems, safety critical elements, and operations may be required. ▶ Grants the appropriate intermediate approvals to conduct test flights and other activities that may require FAA certification, such as experimental aircraft certificates, launch licenses, vehicle registration, operational limitations, and flight restrictions. ▶ Evaluates results of test flights and other activities. ▶ Issues safety approvals for recurring operations of the vehicle.

2.4.1 PERFORMING DESIGN AND OPERATIONS REVIEWS

Consistent with the safety standards and requirements identified in the RLV regulations, the SAT will review the Applicant's engineering design and analyses, proposed operational envelope, personnel qualifications, test plans, and other data. During this phase, the longest in the process, activities described in subparagraphs 2.4.1.1 through 2.4.1.7 will take place.

2.4.1.1 HOLDING REGULAR COORDINATION MEETINGS

The SAT and the Applicant will meet regularly. Communication between both parties, which is a key factor to a successful safety approval project, is an on-going process.

2.4.1.2 VERIFYING AND VALIDATING PERFORMANCE AND RELIABILITY

The SAT provides recommendations to FAA for conditional approval of Applicant's plans. To that end, the team completes the following tasks:

- Review all data to determine the technical soundness of the Applicant's proposal.
- Verify that the Applicant meets all the performance and reliability specifications to ensure public safety for all phases of the RLV operations.
- Conduct independent assessments of critical systems.
- Perform independent assessments of the Applicant's analysis techniques and operations.

2.4.1.3 CONDUCTING CONFORMITY INSPECTIONS

The FAA SAT may conduct conformity inspections and witness activities to verify that the Applicant is building, assembling, testing, and maintaining critical systems. Such inspections confirm compliance with terms specified in the material leading up to the licensing of the launch or operation of the Applicant's concept as documented in the approved FAA SAP.

2.4.1.4 PERFORMING ENGINEERING COMPLIANCE DETERMINATIONS

The SAT performs engineering compliance determinations, verifying that the articles, systems, or vehicles were built as specified in the design drawings and specifications. Quality control of materials and assembly processes are also addressed in these determinations.

2.4.1.5 ISSUING INTERMEDIARY SAFETY APPROVALS

In developing the RLV system, Applicants may require intermediary approvals to perform certain activities critical to the development of the proposed vehicle. To address the full range of safety issues, the FAA requires extensive information on the failure modes of the proposed concept for each specific activity. Such information aids in understanding the level of risk and setting appropriate limitations when considering the Applicant's intermediary safety approval requests.

These approvals may include initial flight tests and other activities that require FAA certification, such as experimental certificates of airworthiness, or launch licenses. These intermediary approvals may be limited through operational and flight restrictions. The SAT members will monitor test flights for compliance with restrictions, limitations, and safety approval procedures.

Envelope expansion approvals may also be part of a flight test program and will be considered by the SAT after review of initial test results and other technical data. These efforts should follow a well-planned progression with specific test objectives and appropriate public safety measures to protect the public.

2.4.1.6 EVALUATING TEST RESULTS

The SAT will conduct independent evaluations of test results to validate the Applicant's conclusions and proposed courses of action.

2.4.1.7 ISSUING OR DENYING SAFETY APPROVALS

Applicants may require a number of safety approvals for RLV operations. The FAA issues or denies safety approvals covering initial and recurring operation of the system after carefully reviewing, verifying, and validating all data gathered throughout the process.

2.4.2 COMPLETING THE FINAL PROJECT EVALUATION REPORT

At the end of each safety approval project, the Applicant's PM and FAA LSE will complete the final project evaluation report to capture and retain the corporate knowledge learned during the project. This summary report should:

- Capture only unique data.
- Include precedent setting issues (e.g., regulatory, policy, or technical).
- Contain the perspectives, feedback, and lessons learned of both the Applicant and the FAA.

This report and relevant attachments should be maintained in the permanent records of the FAA for future reference.

APPENDIX 1: STAKEHOLDER ROLES AND RESPONSIBILITIES

Successful completion of the safety approval process requires all the stakeholders to plan and coordinate their activities very methodically. This appendix highlights stakeholder roles and responsibilities.

APPLICANT STAKEHOLDERS

- **Applicant Project Manager –** Supports the Safety Approval Team (SAT) by:
  - Providing and updating overall schedule of the program including identified analyses, tests, etc.
  - Providing the requested data, analyses, test plans, test schedules, and test results.
  - Maintaining the accuracy of the developing application.
  - Serving as the primary point of contact for the FAA.
  - Coordinating the activities between the FAA and other points of contact within the Applicant's organization, such as the Applicant's subject-matter experts.

- **Executive Management –** Makes a commitment to the safety approval process and provides leadership and resources for assessing the safety of a reusable launch vehicle (RLV) launch system, subsystems, components, and operations.

FAA STAKEHOLDERS

- **Commercial Space Transportation Integrated Product Team (CSTIPT) –** Completes the following tasks:
  - Helps identify and provide the needed technical expertise for a particular project.
  - Coordinates use of additional resources with other lines of business (LOB), as necessary.
  - Reviews individual Safety Approval Plans.

- **Executive Management –** Makes a commitment to the safety approval process and provides leadership and resources for assessing the safety of an RLV launch system, subsystems, components and operations.

- **Executive Steering Group –** Is comprised of Associate Administrators for Commercial Space Transportation and Regulation & Certification and representatives from other FAA LOBs, as needed. This group is responsible for the following activities:
  - Addresses agency-wide, cross-cutting policy and resource issues.
  - Oversees efforts of the CSTIPT.
  - Approves the SAT composition and structure.
  - Reviews the SAT's approach to the safety approval process.

- **Field Offices –** Supports the CSTIPT as necessary.
- **Lead Safety Engineer (LSE) –** Serves as the primary FAA point of contact with the Applicant and coordinates all activities involved in the safety approval process, including establishment of the SAT.
- **Office of Air Traffic Services (ATS) –** Supports the SAT when requested by the CSTIPT.
- **Office of Aircraft Certification Service (AIR) –** Supports the SAT during the safety approval process when requested by the CSTIPT through the following activities:
  - Provides expertise in aircraft systems and design.
  - Provides the resources of AIR Field Offices in support of the safety approval process.
  - Works with the Applicant.
  - Delivers specific approvals and certificates within the time frame established for the project.
- **Office of Airports (ARP) –** Supports the SAT when requested by the CSTIPT.
- **Office of Aviation Medicine (AAM) –** Supports the SAT when requested by the CSTIPT.
- **Office of the Chief Counsel (AGC) –** Provides legal guidance, review, and analysis when requested by the CSTIPT.
- **Office of Commercial Space Transportation (AST) –** Serves as the lead LOB and point of contact for both the Applicant and the other FAA LOBs on any activities related to a specific RLV safety approval process. AST will assign an LSE who will coordinate all activities involved in the safety approval process.
- **Office of Flight Standards Service (AFS) –** Supports the SAT during the safety approval process when requested by the CSTIPT through the following activities:
  - Directs and manages AFS Field Offices in support of the approval process.
  - Works with the Applicant.
  - Delivers specific approvals and certificates within the time frame established for the project.
- **Office of Policy, Planning, & International Aviation (API) –** Supports the SAT when requested by the CSTIPT.
- **Office of Regulation and Certification (AVR) –** Supports the CSTIPT and SAT through its management of AIR, AFS, AAM, and ARM.
- **Office of Research & Acquisitions (ARA) –** Supports the SAT when requested by the CSTIPT.
- **Office of Rulemaking (ARM) –** Supports the SAT when requested by the CSTIPT.
- **Office of System Safety (ASY) –** Supports the SAT when requested by the CSTIPT.

APPENDIX 2: GLOSSARY OF ORGANIZATIONAL CODES, ACRONYMS, AND TERMS

AAM	Office of Aviation Medicine
AFS	Flight Standards Service
AGC	Office of the Chief Counsel
AIR	Aircraft Certification Service
API	Office of Policy, Planning & International Affairs
ARA	Office of Research & Acquisition
ARM	Office of Rulemaking
ARP	Office of Airports
AST	Office of Commercial Space Transportation
ASY	Office of System Safety
ATS	Office of Air Traffic Services
AVR	Office of Regulations & Certification
CSTIPT	Commercial Space Transportation Integrated Product Team
FAA	Federal Aviation Administration
LOB	Line of Business
LSE	Lead Safety Engineer
MIL-STD	Military Standard
PM	Project Manager
RLV	Reusable Launch Vehicle
SAP	Safety Approval Plan
SAT	Safety Analysis Team
SSPP	System Safety Program Plan

Applicant – The corporation, partnership, joint venture, or other entity who applies for a license to launch an RLV, represents the project, has the engineering support data, and is responsible for the continued flight worthiness and operational safety of the vehicle.

Experimental Certificate of Airworthiness – A certificate for the purpose of approving research and development activities that may be necessary in testing new aircraft designs, installations, and operating techniques; in evaluating innovative uses for existing aircraft; and for accessing the viability of reusable launch vehicle projects as a whole.

Launch operator license – Authorizes a licensee to conduct launches, within a range of specific parameters and category of vehicles.

Launch-specific license – Authorizes a licensee to conduct one or more launches, having the same launch parameters, involving one type of launch vehicle, and operating from one launch site.

Lead Safety Engineer – An AST engineer assigned as the primary point of contact for the Applicant and other FAA lines of business. The Lead Safety Engineer makes the initial determination of the composition of the Safety Analysis Team.

Operational restrictions – Limitations on a vehicle's usage and its area of usage designed to ensure a level of safety commensurate with that established in the regulations.

Preliminary safety approval meetings – A meeting or series of meetings between the Applicant and the Safety Analysis Team to obtain clarification regarding the proposed vehicle and its operation.

Project Initiation Form – The document that the Applicant submits to AST expressing intent to apply for an approval or a series of approvals leading to the development or operation of an RLV (eventually leading to a license application). This form will highlight the system description, impacts on public safety, points of contacts, etc.

Reusable launch vehicle – A launch vehicle that is designed to return to Earth substantially intact and, therefore, may be launched more than one time or that contains stages, components, or both, which may be recovered for future use in the operation of a substantially similar launch vehicle.

Safety Analysis Team – A matrix organization under the leadership of the Lead Safety Engineer and comprised of members with the necessary expertise to evaluate a specific proposal. Membership may include engineers, technical specialists, pilots, operation specialists, environmental specialists, and others.

Safety Approval Plan – The principle project coordination tool that states how the FAA and Applicant will conduct the safety approval process. This plan is developed by the Safety Analysis Team, based on the Applicant's specific proposal and input. The Lead Safety Engineer updates this plan as changes occur throughout the life of the program.

Special airspace restrictions – Limitations on the use of airspace required to maintain the safety of the air-traveling public and the ground population during specific hazardous operations.

Special class certification – A certificate for an aircraft that could include a hybrid airplane and rocket design. In these cases, an Applicant pursues a special type certificate and must meet the aircraft criteria. These criteria are tailored to the specific application and design and must meet an established equivalent level of safety.

Special conditions – Safety standards established in situations where existing regulations do not adequately address an aircraft or launch vehicle because of its novel or unusual design features. These additional standards are necessary to institute a level of safety commensurate with those established in the regulations.

APPENDIX 3: SAFETY APPROVAL PROCESS APPLICANT CHECKLIST

PHASE 1

____ Review FAA Regulatory Requirements

____ Develop Preliminary List of System Safety Issues as a Precursor to the System Safety Program Plan (SSPP)

____ Submit Cover Letter and Safety Approval Project Initiation Form to FAA AST

____ Submit Missing Information to FAA AST, as Necessary

PHASE 2

____ Attend Preliminary Familiarization Meetings with FAA

____ Communicate with FAA During Completion of the Following Tasks:

- ____ Establishment of Safety Approval Project
- ____ Formation of Safety Analysis Team (SAT)
- ____ Development of FAA Statement of Responsibilities

____ Submit Additional Information, as Necessary

____ Prepare Initial Project Evaluation Report

PHASE 3

____ Attend Safety Approval "Kick-Off" Meetings with FAA

____ Develop SSPP

____ Submit Data Requirements for Safety Approval Project

____ Continue Communications with FAA as SAT Develops Safety Approval Plan

____ Submit Any Additional Information, as Required

____ Update Project Evaluation Report

PHASE 4

____ Meet Regularly with SAT to Discuss Specific Safety Aspects of the Project

____ Allow Conformity Inspections by SAT and Other FAA Personnel

____ Begin Incremental Testing with Appropriate FAA Intermediary Safety Approvals

____ Provide Test Results to the SAT, as Required

____ Receive Safety Approvals from FAA

____ Complete Final Project Evaluation Report

APPENDIX 4: PROJECT INITIATION FORM

The Applicant is required to fill out a Project Initiation Form when submitting information to the FAA requesting a safety approval project. This appendix provides a sample form to be used as a baseline by the Applicant in describing their concept and outlining their needs and expectations from the FAA.

REUSABLE LAUNCH VEHICLE APPLICANT PROJECT INITIATION FORM

(Attach additional sheets, as needed)

Company Name	
Mailing Address	

Requested Three-Letter Company Identifier in Order of Preference

1.	2.	3.	4.

Applicant Program Manager

Name (Last, First, MI)	
Title	
Contact Data (Address, Tel., E-mail)	

System Description

Number of Stages	
Objects to Achieve Orbit	
Orbital Parameters for Objects Achieving Orbit	
Injection Data	
Propulsion System	
Autonomous Operations	
Ground Controlled	
Misc.	

Proposed Types of Operations	Locations of Intended Operations
	Development
	Targets
	Launches

Milestones Envisioned	
Milestone (Proposed Start Date_____)	**Date**

Safety Issues and Approvals Needed *(To be discussed with the FAA)*

Additional information that provides a better understanding of the proposed operations or business

Statements and information contained on this form denote intent to apply for Safety Approval, Licensing, or both.	
Signature and Date	
Printed Name and Title	
Signature and Date	
Printed Name and Title	

Reserved for FAA Use	
Received by:	**Date**
Remarks	

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